
Selection for Cold Tolerance in Beans

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Beans are generally susceptible to cold. Twenty lines selected for variation in response to cold were subjected to a variety of cold tests at various stages of development. Correlation tests were made between all possible combinations to identify which tests were best suited to identifying cold tolerance in many lines. Tests must be simple to be practical for evaluation of many samples by a bean breeder.

Seed were germinated on blotting paper at 8, 10, and 12C. Surprisingly the snap bean cultivars were usually the first to produce radicles. However, when the same lines were planted in Cornell mix at 8, 10, and 12C, the cultivars usually rotted at 8 and 10C or were very weak if they did emerge from the mix. However, 5 days at 5C followed by 16C or germinating them at 12C were good conditions for separating lines for their cold germination tolerance (Table 1). Under these conditions, cold tolerant lines germinated rapidly and the seedlings were vigorous and could be separated from weak, cold, susceptible lines. These results correlated with field observations.

Growing beans at 16 ± 2C also identified those least delayed in days to bloom by growth at a relatively cool temperature (Table 2). This also agreed with field observations. Weighing the plants at bloom also gave an indication of vigor under cool conditions.

A third period of importance is the bloom period. Keeping the plants at 25/8C D/N for two weeks during bloom resulted in identification of plants which will set under conditions of cool nights. Subsequent studies of the effect of 20, 25, and 30C by day and 8, 10, and 12C by night in all combinations showed that low night temperatures damaged the ovule and the high 30C day damaged the pollen in some cases. 30C does not appear to be very hot but from field observations in 1983 many cultivars can be damaged by temperatures of 30-32C especially in combinations with wide temperature fluctuations.

PI 165426 germinated well, but was late to bloom and suffered from low temperatures at bloom. NY5-161 performed well at all three stages, but was not among the earlier lines to bloom. PIG16597 is very early to bloom, but is intermediate in vigor under cool conditions. Limelight and PI165426 produced more crop under cool early spring conditions than under hot summer conditions. Several other lines produced almost as good a crop in the spring while in some cultivars yield was reduced to 60% or less.

From the study it was concluded that selection would be necessary at all stages to obtain a truly early vigorous cold tolerant bean.

Table 1. Days to emergence of bean lines under various low temperature conditions.

Line	5 days at 5°C then 16°C	Radicle Emergence at			Emergence in Cornell mix at
		8°C	10°C	12°C	12°C
7BP 199	11.4	29	5	3.1	13.4
NY5-161	11.5	40	7	4.0	14.1
PI 165426	11.5	40	7	4.1	14.5
NY 23	11.5	16	6	3.0	11.8
OSU 1604	11.8	16	5	3.0	14.0
NY 590	12.3	25	5	3.1	13.4
NY 36	12.4	32	30	3.7	14.7
Limelight	12.6	-	-	-	13.6
BBL 274	12.6	30	31	6.3	16.8
G1697	12.7	40	37	4.6	15.2
BBL 92	12.7	13	5	3.3	10.9
BBL 47	13.4	19	19	3.1	14.2
Mean	12.4	29	15	3.8	14.5
LSD at 5%	.73	7.7	7.2	1.1	2.6
LSD at 1%	.98	10.4	9.7	1.5	3.5
% CV	7.0	13.3	24.3	14.4	8.9

Table 2. Performance at beans under cool conditions in greenhouse and field²

Pedigree	Days to bloom		Wt gms. at bloom in G House	Vigor at germ in G House
	G House	Field		
Limelight	42-47	41	19	1-3
PI G16597	42-43	45	19	3-4
Oregon 58	42-54	45	14	3
Res. Cherokee Wax	42-43	47	24	3-5
NVRS 222	42-46	45	26	5
Ten. Green Pod	43-46	44	25	4
NVRS 240	43-48	45	27	3
Red Kloud	45-48	43	25	4
Swedish Brown	45-49	49	25	4-5
Top Crop	45-46	48	25	4-5
Contender	45-47	45	21	4
78-142	46-53	49	23	3-4
Provider	46-46	45	17	3-4
5-161W	46-48	46	29	4-5
5-161C	48-48	47	30	4-5
Burly	48-51	48	23	3
NY 4415	48-50	47	30	4-5
BL 92	48-52	53	18	4
G 08050	52-56	55	29	4-5
PI 165426	52-54	53	32	5
BL 47	53-57	49	19	2-3
Andino	55-57	49	29	3-5
Brazil 2	55-57	49	34	4-5
Bonanza	55-59	55	9	1

¹ Grown at 16 ± 2C.² Planted May 13.